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RECORD OF ORAL HEARING

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte TETSUNORI KAJI,
SHINICHI TACHI,
TORU OTSUBO,
KATSUYA WATANABE,
KATSUHIKO MITANI,
and JUNICHI TANAKA

Appeal 2009-003033
Application 10/808,559
Technology Center 1700

Oral Hearing Held: June 25, 2009

Before JEFFREY T. SMITH, MARK NAGUMO, and
MICHAEL P. COLAIANNI, Administrative Patent Judges

ON BEHALF OF THE APPELLANT:

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The above-entitled matter came on for hearing on Thursday, June 25, 2009, commencing at 1:27 p.m., at the U.S. Patent and Trademark Office, 600 Dulany Street, Alexandria, Virginia, before Victoria L. Wilson, Notary Public.

THE USHER: Calendar number 71. Mr. Montone.

JUDGE SMITH: Welcome, Mr. Montone.

MR. MONTONE: Good afternoon.

JUDGE SMITH: After you get settled, as you know, you have 20 minutes to present your arguments.

MR. MONTONE: Okay. Well, yes, it is pretty straightforward, this case, so hopefully it won't take that long.

Essentially, this particular appeal is directed to – this case is sort of a treasure trove of disclosure.

It was one of the very early applications in this area and there is really quite a number of things in here, if you read the spec, but what we are concentrating on today in all of our claims is an improved plasma discharge confinement ring, and if you refer to the drawings, figure 1, for example, you can see this structure identified with the numeral 37 and, effectively, that is a ring that goes around a plasma -- a plasma area where you will be doing etching of a wafer and, in the past, as you can see from the prior art that's been cited, there have been so-called confinement -- plasma confinement rings.

The main difference, as we will discuss shortly here, is that in the past, what they are mostly looking to do is just keep the plasma in the area of where you are etching. They don't want the plasma to go outside of it.

What the present claims are directed to is going beyond that, and as

you can see from figure 1, 37 really substantially completely shuts off the etching chamber, with the exception of a very small opening which is used when you eventually want to evacuate the chamber.

In so doing, as the Applicants discuss in the specification, the purpose that they are seeking is to increase the plasma density inside that etching chamber rather than just holding the plasma in there. So let me go ahead and -- if you refer, for example, to page 40, line 2, of the specification -- which I will find here in a moment -- okay -- I apologize -- what that says, in regard to the surrounding of the processing chamber, 10, since the plasma is confined in the vicinity of the sample, 40, by the discharge confining ring, 37, the plasma density is increased and the attaching of unnecessary deposits to portions outside the discharge confining ring, 37, is minimized.

So that's the one important aspect of the present claims is having this confinement ring not only confined but confined to the extent that as the gas is coming in, it will actually be having its density increased.

JUDGE NAGUMO: So does this mean that the -- because this confining ring actually exerts the force somehow on the plasma so that it is denser or –

MR. MONTONE: Well, the gas is being pumped in and then essentially ignited and it will hit the wall and because it is trying to expand and it is being held in, for the most part, the pressure, the density will actually increase in there.

JUDGE NAGUMO: Okay. So why isn't that fully met by Lenz which shows a set of rings very much like that? You just said it is a wall.

MR. MONTONE: Okay. Well, we will get into that in great detail. Okay. Well, before I go on to that, I want to mention one other thing that

the claims contain and because it is sort of a secondary but still significant issue is that these rings or this confinement ring in this case is constructed of silicon carbide.

In particular, it is constructed of a material that doesn't have oxygen because in the course of all of this, there is a declaration that was submitted in here, the rings in the primary reference to Lenz are constructed of quartz or silica, both of which contain oxygen.

The problem with that is as you increase the density and you start etching with increased density, you are going to start to etch the discharge confinement ring itself.

If you have oxygen, which both quartz and silica do, which Lenz 571 does, then you would actually start to physically put oxygen into the plasma, which you don't want.

We don't think that Lenz has that problem because Lenz does not appear to be operating at the same high density.

Okay. Turning to your question, Mr. Nagumo, of the Lenz '751, the confinement ring here, there is nothing in here that suggests that these rings will increase the density.

In fact, we think quite the opposite. If you look at figures 1 and 2 of Lenz, what you see is that the slots, gaps, as it were, 31, play a very, very critical role for Lenz '751. Basically, especially if you look at figure 2 of Lenz '751, you can see that what you have is these rings, which are, as I mentioned before, made of silica or quartz, which has oxygen, will generate oxygen when etched, and they are spaced apart by specific -- well, you can really see here that the gaps are, basically, almost as big as the rings.

JUDGE NAGUMO: But all I need by the claim is to increase plasma

density. Presumably that's with compared to nothing at all.

So I have got a substantial wall here, it may have a lot of holes in it, and if the primary action is purely physical, reflective wall, largely reflective wall, then it seems that I would meet that but for the composition and it is my understanding that one of the other Lenz references suggests silicon carbide as an equivalent material for this wall and so why is that not prima facie obvious?

MR. MONTONE: I understand your question. I think in response to the first part of your question, I tried to equate this to filling up a glass of water.

If the glass has all of these slots in it -- just picture that structure there as a glass. What's going to happen is as you pour it in, it is just going to come pouring out. The density inside is not going to increase or, at the minimum, they had no interest whatsoever.

If there is some minor increase, but I kind of doubt it, what Lenz does -- it is really fascinating -- I kind of like this invention -- if you look at it, you see in the abstract, it says, "The dimensions of the slot are chosen to ensure that the charge particles of spent gases in the plasma, the interaction spaces, are neutralized by wall collisions as they exit the slots," and he goes on in column 2 to expound on that. Let me just read this to you.

I'm on column 2, line 23, et seq. there, it says,

"Moreover, the slots that are formed are appropriately proportioned such that the distance of charge gas particles from the plasma must travel in the slot and exiting a substantially longer than the mean-free path of the particles so that the exiting particles make at least one collision with the walls of the slots. These collisions with the walls will neutralize the charges

on the particles and the exiting particles are neutral."

So he has got this kind of fascinating system that plasma comes in, he ignites it and, of course, it is going to start to exhaust and as it is exhausting, he designs those slots very specifically so that they neutralize the charge.

So what comes out? The plasma won't be there in its plasma form when it comes out. That's what he is getting at which is -- which is great. It is -- but it is a wholly different way. There is nothing in here about increasing density.

JUDGE NAGUMO: But what's the evidence that the density would not, in fact, be increased? It only needs to be increased by a small amount relative to nothing and so if I have got 90 percent of the container – the open area of the container is some sort of a wall and we know that it has a substantial thickness because the mean-free path of -- it is substantially thicker than the mean-free path of the molecule.

So it is not just going to all stream out, it is going to go out, I would argue, somewhat slowly, it seems, so I still don't see that we are getting -- that we aren't reasonably having an increased density –

MR. MONTONE: Some increase.

JUDGE NAGUMO: -- as the claim 1 -- actually, I guess it is claim 8 actually requires.

MR. MONTONE: Well, yes, there is -- you know, all we can really say is that the structure is literally filled with holes.

There is no disclosure or no interest whatsoever in increasing density and we have an invention which is specifically designed to design a plasma confinement ring which will also increase density.

In the case of claim 28, which is the most specific claim, it

particularly defines the range in which the density is confined to, the range that you are seeking, and one of the problems in the prior art is that that --

JUDGE SMITH: With regard to claim 28, that's a condition of the structure. That's not a limitation on the claim, per se. That means you must have a system -- a structure that's capable, in this case an apparatus, that's capable of providing such a plasma.

MR. MONTONE: Well, what we have is a means. We put it in a functional format just to –

JUDGE SMITH: Okay.

MR. MONTONE: -- cover that -- that's what we are doing so you wouldn't, you know, be given weight in terms of that function limitation.

JUDGE SMITH: Have you defined the means?

MR. MONTONE: Huh?

JUDGE SMITH: Have you defined the means?

MR. MONTONE: In claim 28 -- well, the means is actually the combination of the plasma generation electrodes and the plasma confining ring, so that, otherwise, if you didn't have this confinement in there, you wouldn't have that density.

JUDGE SMITH: Does the Lenz '751 patent describe how many rings are necessary for their invention?

MR. MONTONE: I believe they mention six rings as their preferred embodiment.

In column 2, they say, "confinement at least 3 dielectric rings spaced apart in a manner essentially to form a circular ring having at least a pair of circumferential slots, in addition to the slots. In typical embodiments, six rings were used to form five distinct circumferential slots," et cetera.

JUDGE SMITH: Have you established of the three rings, that such a plasma density could not be achieved?

MR. MONTONE: No, we don't have -- you know, we don't have any specific evidence that says that you would not get an increase in plasma density.

The reference doesn't have any teaching or even remote interest in increasing plasma density, so -- so I guess that's kind of where we stand now.

JUDGE SMITH: But what is the point of a containment ring if it is not to contain the dense –

MR. MONTONE: That's a very good question. The fundamental question, why do they call it "confinement ring."

The reason they call it "confinement" is because they want to keep the plasma inside and that's what I like about Lenz. I think it is just kind of fascinating that they design these slots so that as the gas flows out, it is neutralized.

So it is plasma on the inside -- I mean if you picture this -- that's what's interesting.

If you take this cup and you put slots all the way around it and you pour water in, you will have water inside and you will have water outside.

In Lenz, basically, yes, you still have the material but they put it in so you have plasma inside and no plasma outside, notwithstanding all of those slots, and they –

JUDGE NAGUMO: I would submit a closer picture might be a leaky balloon that you are pumping air into or hot air into, maybe ballooning it. It's got holes in it so air is streaming out but you are pumping air into it at

the same time, so as long as you are –

MR. MONTONE: That's our invention. Actually, that's the difference. Our invention is more like that balloon with the little hole that's expanding, but you confine the size of it so the density inside increases and, yes, there is a little leak going out but it is very, very slow and that's why we have it. Their's is the slotted cup.

JUDGE NAGUMO: Well, that's the argument here --

MR. MONTONE: Yes, that's the argument.

JUDGE NAGUMO: -- how slotted is it. If we could go to the composition aspect because you raised it earlier and the claim requires silicon carbide.

MR. MONTONE: Right.

JUDGE NAGUMO: And is it Lenz '5 --

JUDGE SMITH: '356.

JUDGE NAGUMO: -- '356, I believe.

MR. MONTONE: '356, yes, and that's an interesting question.

JUDGE NAGUMO: And if you could address that.

MR. MONTONE: Obviously, Lenz knew about silicon carbide but he did not use it. He specifically taught I want it to be silica or quartz. He is quite emphatic about that, notwithstanding the fact that his earlier patent used a related structure.

Our conclusion from that is that he must have decided that that material doesn't work as well to create these collisions. Why, I have no idea. But if he was so aware of it, why wouldn't he have suggested it.

JUDGE SMITH: Lenz '751 in column 6 says that it should be made of a dielectric, preferably silica or quartz.

MR. MONTONE: Right.

JUDGE SMITH: So that's a preferred embodiment.

MR. MONTONE: That's true. He doesn't rule it out.

JUDGE SMITH: So is silicon carbide a dielectric as Lenz '356 says?

MR. MONTONE: Yes. Yes. So it is true, and that's why I said that's kind of a subsidiary argument. Our -- our principal argument really comes down to the fact that in Lenz, you have got -- if you look at figure 2 especially, you have got what is obviously a very leaky structure.

You have got an arrangement very specifically designed concerning the size of those big slots to neutralize the plasma as it comes out, and that if you start to, for lack of a better word, mess with Lenz to change those slots to increase density inside the chamber, you will totally destroy the purpose of Lenz because that's not what he wants to do.

So that's kind of it. And, you know, I guess all I can really ask you to do is hopefully -- our view of it is that we are talking about this cup with water coming in and all of these slots as compared with the balloon analogy that you set forth, except that you limit the size that the balloon can expand to and there is only this one hole so, boom, it comes out. We specifically designed it to increase the plasma density and, in particular, to increase it to a particular level and allow you to maintain a level as defined in claim 28.

JUDGE SMITH: Do you have a depiction of the vacuuming portion in your figures?

MR. MONTONE: I don't think so. I mean we sort of have a schematic in figure 40 as to gas coming in and going out.

JUDGE SMITH: Looking at figure 39, and I presume the plasma chamber is identified as 10 therein –

MR. MONTONE: Okay. Yeah.

JUDGE SMITH: -- would the openings on each side be considered your opening?

MR. MONTONE: Yep. Yeah, exactly, and then there is this outer chamber that goes into and then it gets evacuated.

JUDGE SMITH: Right.

MR. MONTONE: So --

JUDGE SMITH: Do you have anything else?

MR. MONTONE: No. That's it.

All right, gentlemen, thank you.

JUDGE NAGUMO: Thank you.

JUDGE SMITH: Thank you.

Whereupon, the proceedings at 1:46 p.m. were concluded.